

SYSTEM-OF-SYSTEMS THAT ACT LOCALLY FOR OPTIMIZING GLOBALLY

EU FP7 - SMALL/MEDIUM-SCALE FOCUSED RESEARCH PROJECT (STREP)
FP7-ICT-2013.3.4: ADVANCED COMPUTING, EMBEDDED AND CONTROL SYSTEMS
D) FROM ANALYZING TO CONTROLLING BEHAVIOUR OF SYSTEM OF SYSTEMS (SOS)

Local4Global Consortium Meeting

Building Use Case

Thomas Schild, RWTH Aachen University

09.10.2014

Eibar, Spain

LOCAL⁴ GLOBAL

Local⁴ Global

Contact Information

For information regarding this Project: Check the Project Web-Site: <http://local4global-fp7.eu>

Participants	
1	CERTH - Centre for Research and Technology
2	ETHZ – Eidgenössische Technische Hochschule Zürich
3	RWTH – RWTH Aachen University
4	IK4 – IK4 TEKNIKER
5	TRV – TRANSVER GmbH
6	TUC – Technical University of Crete
7	TUM – Technische Universität München

Project Acronym: Local4Global

Project Number: 611538

Project Start Date: October 2013

Duration: 3 Years

Funded by: EU FP7

Program Name:

EU FP7 - SMALL/MEDIUM-SCALE FOCUSED RESEARCH PROJECT (STREP)
FP7-ICT-2013.3.4: ADVANCED COMPUTING, EMBEDDED AND CONTROL SYSTEMS
D) FROM ANALYZING TO CONTROLLING BEHAVIOUR OF SYSTEM OF SYSTEMS (SOS)

Building TSoS

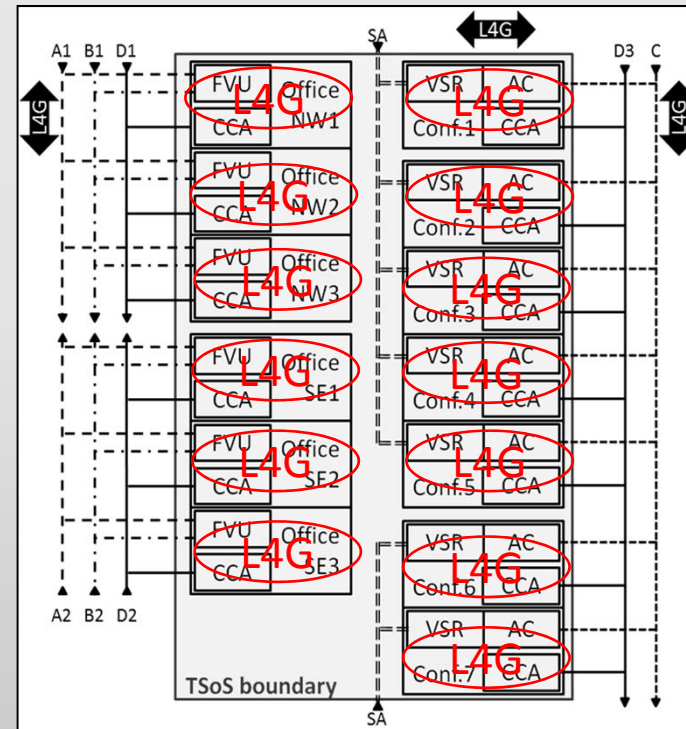
- Down-scaled building for project work
- 2 groups of 3 offices
- 3-7 conference rooms of variable size
- Energy distribution in
 - 4 water nets (A,B,C,D)
 - 1 air duct-net (SA)
 - Different ratio of renewable energy
- Fix ratio of renewable energy per hub
- SoS-effect: overall ratio of renewable energy depends on the shift of loads from hub to hub
- **Local4Global as room controller**

$$\max \sum_{i=1}^m \dot{Q}_{d_i}^{ren}$$

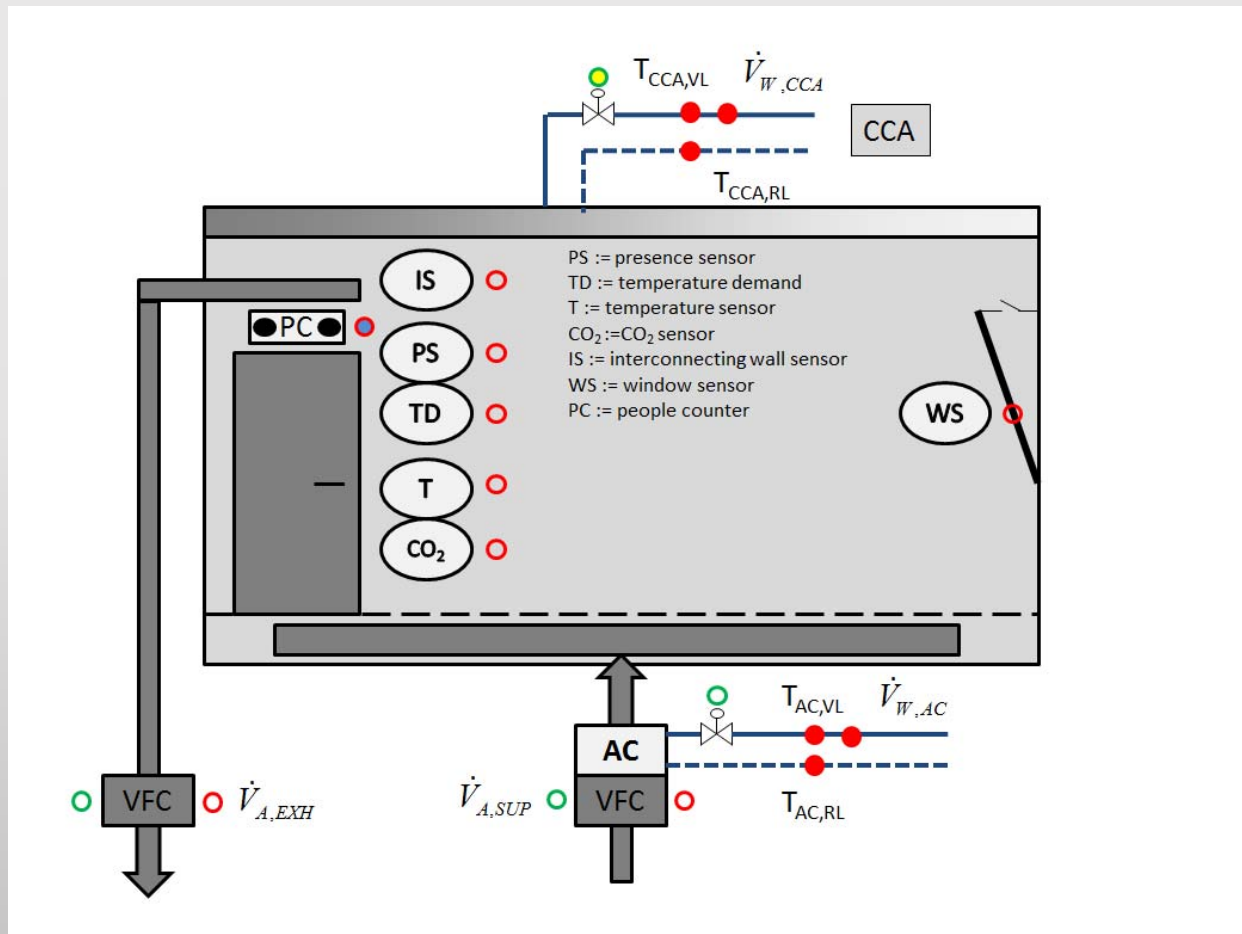
Subject to $\dot{Q}_{d_i}^{ren} = \dot{Q}_{d_i} \cdot f_{d_i}^{ren}(t)$

Constrained by $\sum_{i=1}^m \dot{Q}_{d_i} \leq (\dot{Q}_d)_{max}$

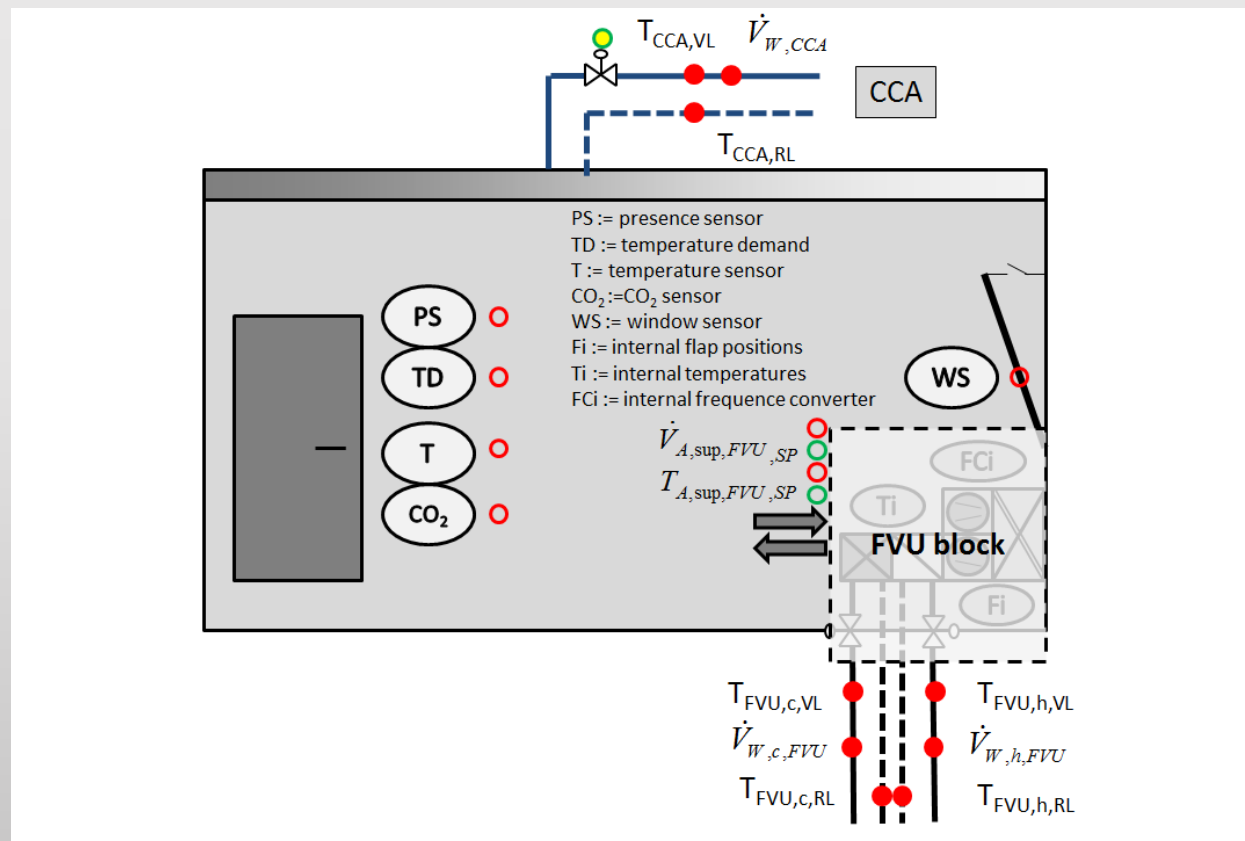
with $d \in (A1,A2,B1,B2,C,D1,D2,D3,SA)$



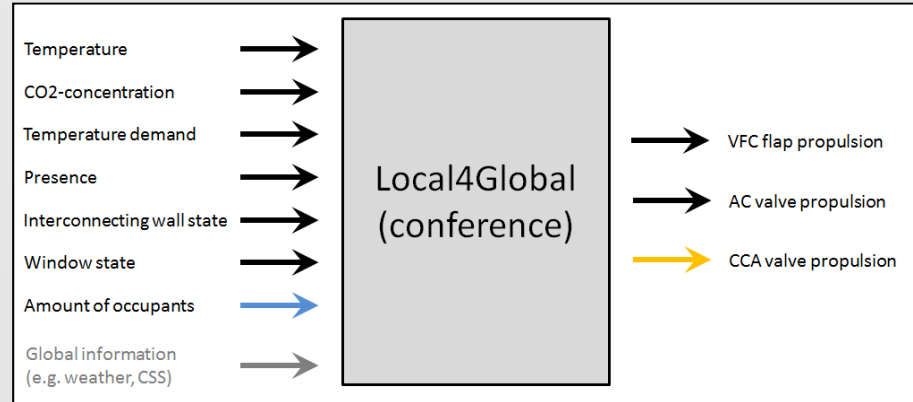
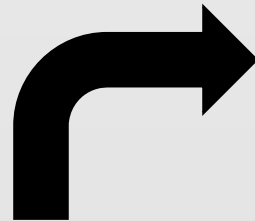
Conference constituent system



Office constituent system

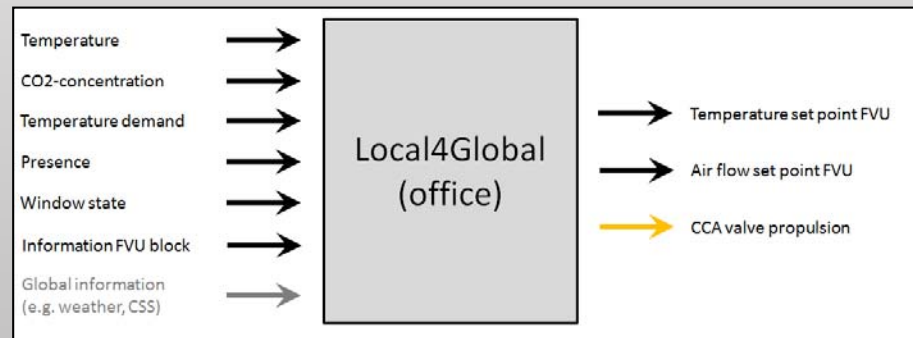
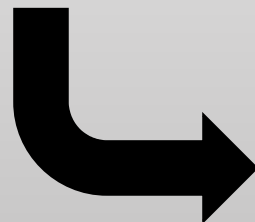


Control task



Implementation:

- Computational power
- Platform
- Konfiguration



Software relations

- Possibility 1:
 - Central solution (see D.5.2.1)
 - Algorithm as MATLAB code on a VM
 - Coupling to Modelica with TISC-interface
 - Coupling to building with MCIS
 - Field components are controlled by MATLAB directly
- Possibility 2:
 - Real distributed solution (new idea)
 - New equipment contains controllers
 - JAVA based platform (algorithm as encapsulated black box object)

ANY QUESTIONS?

References

Diakaki, Christina, et al. *Technical System of Systems Modelling and Analysis Requirements*. Deliverable 2.1, EU Local4Global FP7-ICT project #611538, 2014.

Ettinger, Roland, Michael Krause, Thomas Schild, and Roozbeh Sangi. *Use Case Requirements*. Deliverable 2.3, EU Local4Global FP7-ICT project #611538, 2014.

Schild, Thomas, and Roozbeh Sangi. *1st Implementation Plan: Building Use Case*. Deliverable 5.2.1, EU Local4Global FP7-ICT project #611538, 2014.

Schild, Thomas, Roozbeh Sangi, Tudor Ungureanu, Roland Ettinger, and Michael Krause. *Evaluation Plan (1st version)*. Deliverable 6.1.1, EU Local4Global FP7-ICT project #611538, 2014.

Upcoming paper, *System of Systems theory as a new perspective on building control*, European Control Conference ECC 2015, Linz, 2015

RWTH Aachen University

- Univ.-Prof. Dr.-Ing. Dirk Müller , Head of the Institute



- Dr.-Ing. Rita Streblow, Chief Engineer



- Dipl.-Ing. (FH) Thomas Schild M.B.A., Research Associate



- Dipl.-Wirt.-Ing. Johannes Fütterer , Research Associate



- Roozbeh Sangi, M.Sc., Research Associate

